Too far, too little, too late: a community-based case–control study of maternal mortality in rural west Maharashtra, India*

B.R. Ganatra,[1] K.J. Coyaji,[2] & V.N. Rao[3]

A total of 121 maternal deaths, identified through multiple-source surveillance in 400 villages in Maharashtra, were prospectively enrolled during 1993–95 in a population-based case–control study, which compared deaths with the survivors of similar pregnancy complications. The cases took significantly longer to seek care and to make the first health contact after the decision to seek care was taken. They also travelled significantly greater distances through a greater number of health facilities before appropriate treatment was started.

Multivariate analysis showed the negative effect of excessive referrals and the protective effect of the following: residing in and not away from the village; presence of a resident nurse in the village; having an educated husband and a trained attendant at delivery; and being at the woman's parents' home at the time of illness. Other significant findings showed that deaths due to domestic violence were the second-largest cause of deaths in pregnancy, that more than two-thirds of maternal deaths were underreported in official records, and that liveborn infants of maternal deaths had a markedly higher risk of dying in the first year of life.

This study points to the need for information–education–communication (IEC) efforts to increase family (especially male) preparedness for emergencies, decentralized obstetric management with effective triage, and a restructuring of the referral system.

Introduction

The launch of the global Safe Motherhood Initiative (SMI) in Nairobi in 1987 and the subsequent World Summit for Children in 1990 brought into focus the hitherto "neglected tragedy" of maternal mortality (*1*). A decade later, maternal deaths in India still account for 13% of all deaths among women in the reproductive age group (*2*). National estimates of maternal mortality are in the range 4–5.5 per 1000 live births (*3*, *4*), with vast regional and rural–urban differentials. In rural Maharashtra, the site of the present study, maternal mortality ratios have been variously estimated as 3.3 per 1000 live births (*5*) and 2.16 per 1000 live births (*6*).

It is becoming increasingly accepted that many pregnancy-related complications, unlike other public health problems, cannot be prevented or even predicted, though they can be treated. Reduction in maternal mortality can thus be achieved by decreasing fatalities from these complications by means of prompt and effective management. In the light of this, it becomes increasingly important to study the events from the onset of a complication to death/recovery and to delineate the factors that determine survival in a woman who develops a complication. However, there is a paucity of studies documenting or quantifying the role of such factors. This article describes an attempt to address this issue with a population-based, matched case–control study, which compared maternal deaths with women with a similar biomedical complication who survived.

Methods

The study area covered 400 villages, with a total population of 686000, spread over well-delineated but noncontiguous rural areas in the Pune, Aurangabad, and Ahmednagar districts of Maharashtra State. The public health infrastructure in the study area is similar to that of the rest of the state. Comprehensive care for obstetric complications (emergency operations/blood transfusion) is available only at the district hospitals and teaching hospitals. Parts of the study area are also served by small private hospitals offering various levels of patient

* From: KEM Hospital Research Centre, Pune, India.

[1] Honorary Consultant, KEM Hospital Research Centre, Sardar Moodliar Road, Rasta Peth, Pune 411 011, India. Requests for reprints should be sent to this author.

[2] Director, Department of Obstetrics and Gynaecology, KEM Hospital, Research Centre, Pune, India.

[3] Director, Research, KEM Hospital Research Centre, Pune, India.

Reprint No. **5901**

care. Cases were enrolled prospectively over the period 15 January 1993 to 15 December 1995. The case-finding methodology was determined by several factors — incompleteness of official vital registration data, departure from the study area due to the traditional custom of delivering at the woman's parental home, the problems involved in many such home deliveries, and the logistics of covering the vast geographical area with limited resources and a research team of just four persons. All deaths to women in the 15–45-year age group were identified by collating information from several sources such as vital registration records, primary health centre registers, municipal corporation records of nearby towns and cities, surveillance of public service and private medical facilities draining the study area, and an informal "village information system" composed of community health volunteers, women's groups (*mahila mandals*), and school teachers. All deaths were screened to determine whether they were pregnancy-related and whether they were maternal. All identified maternal deaths were enrolled in the study without exception. The ICD-10 definition of maternal death[a] was used as the case definition.

The controls were drawn from the same population base as the cases. Information from several sources such as vital registration records, primary health centre registers, public and private medical facilities serving the study area, and the "village information system" was used to identify women who had been pregnant during the study period. These potential controls were divided into two groups — women with normal pregnancies and women with serious pregnancy-related complications.

Each maternal death was matched to two or more women with the same biomedical complication (complication-matched control) and to one normal pregnancy from the same village (geographical control). All controls were randomly selected from the control pool.

Data collection included a structured interview as well as histories taken from the husband's family and the woman's own family, interviews with health care providers, and a review of available medical records. A panel of pubic health specialists and obstetricians determined the medical cause of death and delineated potentially preventable factors for each death. Families were followed up one year later to ascertain the fate of the liveborn children of the maternal deaths.

[a] Death of a woman while pregnant or within 42 days from the end of pregnancy, irrespective of the duration and site of pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not accidental or incidental causes.

Uni- and bivariate descriptive statistics were calculated using SPSS software. Unadjusted odds ratios using matched analysis were estimated for comparison of cases with controls, using the maximum likelihood method. The use of MULTLR software permitted matched analysis of cases compared with 1–3 controls per case (*7*). Multivariate logistic regression models (adjusted matched odds ratios) were also developed. Cause-specific models were built up using subsets of the data. Attributable risk percents were calculated for potentially preventable factors.

Results

Identifying maternal deaths. Of the 570 deaths identified during the study period among 15–45-year-old women, 121 (21.2%) fitted the ICD-10 definition of maternal death and were enrolled as cases. An additional 19 deaths occurring in pregnancy were identified; 16 of these were related to domestic violence. Only 31 cases (28.1%) were correctly recorded as maternal deaths in the vital registration records; the other deaths were either not registered at all (31.4%) or misclassified as due to non-maternal causes (40.5%).

Cause of death. Table 1 shows that direct obstetric causes accounted for 71.9% of the maternal deaths;

Table 1: **Biomedical causes of maternal deaths**

	Number (n = 121)
Direct causes:	87 (71.9)[a]
Postpartum haemorrhage (PPH)	37 (30.6)
Antepartum haemorrhage (APH)	6 (4.9)
Puerperal sepsis	16 (13.2)
PHI/Eclampsia	10 (8.3)
Ruptured uterus	1 (0.8)
Ectopic pregnancy	2 (1.6)
Embolism (pulmonary/amniotic fluid)	2 (3.3)
Obstetric tetanus	1 (0.8)
Anaemia, CCF	7 (5.8)
Related to anaesthesia	1 (0.8)
Related to abortion (haemorrhage, perforation)	4 (3.3)
Other direct causes	
Indirect causes:	34 (28.1)
Infective hepatitis	9 (7.4)
Cerebral malaria	10 (8.3)
Other infections (pneumonia, typhoid, etc.)	7 (5.8)
Pre-existing medical conditions (hypertension, rheumatic heart disease, etc.)	8 (6.6)

[a] Figures in parentheses are percentages.

the remaining 28.1% were due to indirect medical causes. Postpartum haemorrhage (PPH) was the largest cause of mortality (30.6%), followed by puerperal sepsis (13.2%), eclampsia (8.3%), and cerebral malaria (8.3%); 3.3% of mortality was a result of post-abortion complications arising from haemorrhage or uterine perforation. There were no deaths from post-abortion sepsis.

Place of death. Nearly half the women (46.5%) died outside of a health facility (26.4% at home, 6.6% in transit from home to a health facility, and 11.5% on the way from one facility to another). Only 37.1% actually reached a hospital capable of dealing with obstetric emergencies prior to death (Table 2). Even among those who reached hospital, the interval between admission and death was <6 hours in 43% of the cases and <2 hours in 22.2%.

Time between onset of complication and death. The median time interval between onset of symptoms and death in untreated cases was calculated separately for some common obstetric complications. They ranged from as little as 5.7 hours for postpartum haemorrhage and 11.5 hours for antepartum haemorrhage to 1.7 days for eclampsia and 2.4 days for puerperal sepsis.

Comparison of women who died and women with normal pregnancies. In this comparison (Table 3), the number of years of the husband's education was significantly associated with maternal survival; there was no statistical association between the extent of the woman's education and the risk of maternal death. Proxies for higher economic status did not have any significant effects except for TV ownership,

Table 2: **Places of maternal deaths**

	No. of deaths (n = 121)
At home	32 (26.4)[a]
In transit:	
Home to health facility	8 (6.6)
Between two facilities	14 (11.5)
Places without emergency operative/blood facilities:	
Primary health centre	1 (0.8)
Rural hospital	1 (0.8)
Minor rural health facilities (private)	16 (13.2)
Minor urban maternity hospitals	4 (3.3)
Places (government/private) with emergency operative/blood facilities:	
District hospital	2 (1.6)
Others	43 (35.5)

[a] Figures in parentheses are percentages.

Table 3: **Unadjusted odds ratios (with 95% confidence limits) comparing maternal deaths with normal pregnancies (geographic controls)**

Factor	Odds ratio
Husband's education:	
0 years	2.77 (1.6–4.55)[a]
1–5 years	1.9 (1.1–3.16)
6–10 years	1.1 (0.7–1.8)
>10 years	1 (baseline)
Owning a TV	0.64 (0.44–0.95)
Age of woman:	
<20 years	1.61 (1.1–2.3)
20–29 years	1 (baseline)
30–35 years	2.2 (1.3–3.7)
>35 years	2.67 (1.2–5.3)
Gravida:	
First vs. second	1.68 (1.1–2.66)
5+ vs. second	1.58 (1.1–2.61)
Pre-existing medical illness	7.2 (2.8–18.35)
Antenatal care:	
None	3.33 (1.9–5.4)
1–3 visits	1.3 (0.8–1.91)
>3 visits	1 (baseline)
Untrained delivery attendant	2.2 (1.8–2.67)

[a] Figures in parentheses are 95% confidence limits.

which was protective (odds ratio (OR) = 0.64; 95% confidence limits (CL), 0.44–0.95). Being <20 years or >35 years of age carried a higher risk of maternal death. The first pregnancy as well as the fifth or higher order pregnancies had a greater risk than the second. A pre-existing medical condition such as hypertension, diabetes or heart disease was likely to increase the chances of a woman dying during the pregnancy. Not taking advantage of antenatal care increased the odds of dying (OR = 3.33; 95% CL, 1.9–5.4), as did delivery by an untrained attendant (OR = 2.2; 95% CL, 1.8–2.6).

Comparison of women who died and complication-matched controls. Unadjusted odds ratios comparing deaths with complication-matched controls (Table 4) also showed a strong association between duration of husband's education and maternal survival. Again, no statistical association was found between the woman's educational level and the risk of maternal death. Proxies for higher economic status such as having a separate kitchen (OR = 0.62; 95% CL, 0.4–0.9) or electricity in the house (OR = 0.46; 95% CL, 0.28–0.77) exerted a protective effect. The local custom of the woman moving temporarily to her mother's house during the 8th or 9th month of pregnancy also seemed to have a protective effect (OR = 0.55; 95% CL, 0.35–0.87). The risk of maternal mortality was higher for women who were not in monogamous marriages (OR = 2.2; 95% CL, 1.10–6.3). The increased risk of being <20 years or >35

Table 4: **Unadjusted odds ratios (with 95% confidence limits) comparing maternal deaths with complication-matched controls**

Factor	Odds ratio
Husband's education:	
0 years	4.8 (2.4–9.6)[a]
1–5 years	3.19 (2.3–7.02)
6–10 years	1.06 (0.53–2.2)
>10 years	1 (baseline)
Separate kitchen	0.62 (0.4–0.9)
Electricity in house	0.46 (0.28–0.77)
In the mother's home at time of illness	0.55 (0.35–0.87)
Not in a monogamous marital relationship	2.2 (1.1–6.3)
Age of woman:	
<20 years	1.61 (1.1–2.3)
20–29 years	1 (baseline)
30–35 years	2.2 (1.3–3.7)
>35 years	2.67 (1.2–5.3)
Antenatal care:	
None	2.46 (1.2–4.19)
1–3 visits	1.7 (0.99–2.64)
>3 visits	1 (baseline)
Haemoglobin <11 gm/100 ml	2.8 (1.1–6.8)
Untrained delivery attendant	1.9 (1.12–3.18)
Residence in hamlet cf. village proper	1.93 (1.1–5.3)
No emergency transport in village	2.38 (2.1–2.8)
No doctor in village	1.86 (1.17–2.8)
No phone in village	1.95 (1.2–3.3)
No traditional birth attendant in village	2.77 (1.5–4.6)
No auxiliary nurse-midwife (ANM) in village	3.1 (1.9–5.1)

[a] Figures in parentheses are 95% confidence limits.

Table 5: **Case–control comparisons of the median distances travelled to reach the health facility[a]**

	Controls	Cases	Significance (*P*-value)
Overall distance travelled from home to appropriate treatment facility	39.3 km	63.5 km	0.01
Distance of first health service contact	2.5 km	3 km	0.43
Distance between first health service contact and appropriate treatment facility	35 km	60.5 km	0.03

[a] Indirect causes of maternal mortality not included.

years of age continued to be seen, but associations between the order of pregnancy and death were not identified when cases were matched for type of complication. Lack of health contacts during the antenatal period significantly increased the odds of dying (OR = 2.46; 95% CL, 1.4–4.1), as did antenatal anaemia (OR = 2.8; 95% CL, 1.1–6.8). No statistical associations were found between past use of contraceptives and maternal mortality. Delivery at home with an untrained attendant was seen to be unsafe (OR = 2.02; 95% CL, 1.9–6.8). Women living in hamlets had a greater risk of dying (OR = 1.93; 95% CL, 1.1–5.3) than those living in the village proper. Lack of readily available emergency transport in the village increased the risk of dying (OR = 2.38; 95% CL, 2.1–2.8), as did the absence of a trained birth attendant (OR = 2.77; 95% CL, 1.5–4.6), nurse (OR = 3.1; 95% CL, 1.9–5.1) or doctor (OR = 1.86; 95% CL, 1.17–2.18) in the village. Distance from the primary health care centre, the highway, or the nearest town or city was not significantly associated with maternal death.

The interval between the onset of complication and death/recovery was subdivided into the time between onset of symptoms and decision to seek care, the time between decision to seek care and making the initial health contact, and the time between the first health contact and reaching an appropriate health care facility. Case–control comparisons were made for these time factors as well for distances travelled and the number of referrals prior to reaching the appropriate level of care. Cases, compared with controls, travelled significantly greater distances (Table 5) through a greater number of health facilities and took much longer to reach appropriate treatment facilities (Table 6). There was also a greater delay on the part of cases in making the initial health contact, though the distances travelled were similar. The delay in seeking care was greater for cases.

Adjusted odds ratios (Table 7) were calculated to estimate the independent effect of all these factors. The final logistic regression showed that the greater the number of places travelled (for referrals) in order to reach an appropriate level of care, the higher was the risk of mortality (OR = 2.24; 95% CL, 1.1–5). Protective influences were seen with the following: a trained attendant at delivery, residence within the village, availability of a resident nurse in the village, an educated husband, and staying in the woman's parents' home at the time of illness.

Disease-specific adjusted odds ratios were calculated for the common complications such as haemorrhage, eclampsia and puerperal sepsis (Table 8). Prompt receipt of blood transfusion significantly reduced the risk of dying from PPH, while having to go through two or more referrals increased the risk of dying twelvefold. For eclampsia also the number of referrals prior to reaching hospital was the crucial determinant of survival. On the other hand, delay in seeking care was a crucial factor that increased the risk of dying from puerperal sepsis. Having an educated husband as well as being in

Table 6: **Case–control comparisons of the median time intervals between onset of complication and seeking treatment**[a]

	Controls	Cases	Significance (*P*-value)
Overall delay between onset of complications and reaching an appropriate treatment facility	12.3 hours	34 hours	<0.01
Delay in seeking care:			
Time interval between onset of complications and decision to seek care	2 hours	8 hours	0.02
Time interval between decision to seek care and making the first health service contact	2.5 hours	4.1 hours	0.05
Health services delays:			
Time interval between making the first health service contact and reaching an appropriate treatment facility	4.9 hours	12 hours	<0.01
No. of health facilities from which treatment was taken, i.e. no. of referrals	2	3	0.034

[a] Indirect causes of maternal mortality not included.

the wife's parents' home both had an independent protective effect.

Panel review. The expert panel review of maternal deaths found that logistic difficulties in obtaining transport or money played a role in 45% of the deaths, inadequate medical management at hospital level in 25% of the cases, and shortages of blood and other essential drugs in 28% of the deaths.

Attributable risk percent. Table 9 highlights the attributable risk percent of some potentially preventable factors from the public health viewpoint. The potential importance of any factor taken in isolation in preventing maternal mortality should be interpreted with caution since factors may be interrelated.

Maternal mortality and child survival. The risk of a stillbirth was higher with maternal deaths than with normal pregnancies (OR = 5.2; 95% CL, 2.1–7), and was higher among maternal deaths, even compared with women having the same pregnancy-related complication (OR = 2.3; 95% CL, 1.6–3.88). The risk of a low-birth-weight baby was significantly higher among maternal deaths (OR=3.47; 95% CL, 1.9–6.4) when compared to normal pregnancies. Liveborn children of maternal deaths had a poorer chance of survival throughout infancy. Compared with normal pregnancies, the relative risk of dying in the first year of life was 28 (95% CL, 10.9–32). The relative risk of infant mortality of the liveborn infants of maternal deaths, compared to survivors of complications was 9.4 (95% CL, 4.4–20.4). The majority of the infant mortality in both cases and

Table 7: **Adjusted odds ratios for maternal deaths compared to complication-matched controls**

Factor	Odds ratio
No. of referrals[a]	2.24 (1.1–5)[b]
Moved to mother's house[c]	0.44 (0.25–0.76)
ANM (auxiliary nurse-midwife) in village[d]	0.42 (0.23–0.77)
Educated husband[e]	0.46 (0.24–0.87)
Trained delivery attendant[f]	0.49 (0.27–0.88)
Residence within the village[g]	0.36 (0.2–0.64)

[a] >2 health contacts prior to reaching appropriate care vs. ≤2 contacts: dichotomous.
[b] Figures in parentheses are 95% confidence limits.
[c] Moved to parent's home cf. did not move: dichotomous.
[d] Presence of resident ANM in village vs. no ANM: dichotomous.
[e] Continuous variable with number of years of schooling.
[f] Trained vs. untrained attendant at delivery: dichotomous.
[g] Residence in the village cf. hamlets outside: dichotomous.

Table 8: **Disease-specific adjusted odds ratios with 95% confidence intervals**

Factor	Odds ratio
Postpartum haemorrhage:	
Blood transfusion received	0.05 (0.01–0.28)[a]
No. of referrals	12.1 (1.6–12.5)
Educated husband	0.13 (0.02–0.79)
Eclampsia:	
No. of referrals	2.23 (1.23–2.48)
Puerperal sepsis:	
Delay in seeking care	2.1 (1.3–2.28)
Being at mother's house	0.55 (0.26–0.81)
Educated husband	0.34 (0.02–0.89)

[a] Figures in parentheses are 95% confidence limits.

Table 9: **Attributable risk percent of potentially preventable factors**

Factor	All deaths vs. complication-matched controls (attributable risk %)	All deaths vs. normal pregnancies (attributable risk %)
Illiterate husband	86.4	63.9
Woman's age:		
<20 years	41.2	37.9
>35 years	88.1	62.6
Multiparity (>4 pregnancies)	—	36.7
No antenatal care	59.4	70
Haemoglobin <11 gm/100 ml	64.3	—
Home delivery	50.5	—
Untrained delivery attendant	47.7	54.6
Absence of emergency transport in village	58	N.A.
Absence of ANM (auxiliary nurse-midwife) in village	67.7	N.A.

controls occurred during the early neonatal period. There was no difference between the survival of male and female children.

Discussion

The underreporting of maternal deaths in vital registration data has been noted elsewhere, even in countries with relatively complete registration (*8*, *9*). While multiple-source methodology to identify deaths may not be practical on a large scale, it could be incorporated into the health system on a sample basis as a cross-check on registration data. The use of the ICD-10 "pregnancy-related death" definition as the working definition of maternal death would also simplify registration and reduce inadvertent misclassification because it requires only that a woman was pregnant or delivered recently, and does not need any causal link to be made between cause of death and pregnancy.

Although deaths from domestic violence are not included in the ICD-10 definition of maternal death, in the present study they accounted for 15.7% of all deaths in pregnancy. Thus, domestic violence was the second-largest cause of pregnancy-related mortality, exceeded only by postpartum haemorrhage. Again, use of the above-mentioned "pregnancy-related death" definition can serve to bring violence into the purview of the health agenda.

The medical causes of maternal mortality in this study were similar to the picture seen worldwide, but the proportion of post-abortion deaths was surprisingly lower than has been reported elsewhere (*10*, *11*). This coupled with the fact that not a single death was due to septic abortion suggests that, in the study area, abortions (whether legal or illegal) were being performed in relatively "safe" circumstances.

Here, as in other developing countries, nearly half the women died outside of a health facility (*11–13*). This can be explained both by the extremely short time available for action after the onset of a complication, especially in the case of PPH, as well as by the delays that occur in reaching appropriate care. Similar to the three-phases delay model proposed by Thaddeus & Maine (*14*), the present study has shown that delays in seeking care and health system delays, once the family has decided to seek care, contribute to maternal mortality.

The lack of association between women's education and survival probably reflects the peripheral role women play in making decisions, especially when they themselves are ill. The protective roles of being at the woman's mother's home at the time of illness and of an educated husband remained even after controlling for socioeconomic factors and may both operate by increasing the promptness with which treatment-seeking decisions are made. Increased information–education–communication (IEC) efforts directed at male involvement and family preparedness for possible emergencies could pay rich dividends. There was a protective effect from having a trained attendant at delivery and an auxiliary nurse-midwife (ANM) available in the village, who could guide and promote prompt action when a complication developed and encourage institutional delivery or, at the very least, a trained person's presence at the time of delivery.

Logistic factors (lack of emergency transport, finance, and residence in remote parts away from the village) are responsible for cases taking significantly longer to make a health contact, even after having decided to do so. Potential ways of reducing this delay include exploring innovative community-ponsored transport and financial loan schemes.

Delays in seeking treatment are, however, overshadowed by critical health service delays that operate after a woman has made her first health contact. Thus, the number of referrals that the woman undergoes before reaching an appropriate health facility was a crucial determinant of survival. The inability of most health facilities (both private and government) to deal with obstetric complications and unwillingness to accept potentially serious cases lead to patients being shunted from one facility to another. The stepwise hierarchical referral system, where referral is an end in itself, further increases misreferrals. Redesigning the referral system to include bypassing inappropriate referrals, and identifying and strengthening area-specific institutions (government and nongovernmental) which are potentially capable of providing obstetric care, would thus be an effective way of reducing the time spent in reaching an appropriate level of care. This should be coupled with stricter referral audits and making the referring facility responsible for the patient until she reaches the referral centre.

In addition to reducing delays in accessing care, ways to increase the time between onset of a complication and possible death also need to be explored, especially for a complication such as PPH. Use of intramuscular oxytocics by delivery attendants and peripheral health facilities, as well as upgrading the skills of lower-level health facilities in the effective use of blood substitutes (volume expanders) and in the technique of manual removal of the placenta could increase the time available to transport a woman with haemorrhage to a level of care where blood transfusions are available.

Medical review of each case highlighted deficiencies in hospital management of cases, such as administrative blockades that delay access to blood or drugs, inadequacy of qualified staff, and overburdening of one or two institutions with the responsibility of dealing with referrals from a large area. Decentralization of obstetric case management with an effective triage is needed. Other potentially targetable factors with a high attributable risk include delaying the first pregnancy to beyond the teenage years, treating anaemia preferably before a pregnancy (i.e. in adolescence), and ensuring at least one health contact per trimester of pregnancy.

The study also demonstrated the close links between maternal and fetal survival. Since obstetric complications in the mother have an effect on the fetus, it is to be expected that the risk of stillbirths is higher among maternal deaths. Since the risk for stillbirths continued to be higher among maternal deaths, even compared with women having the same pregnancy-related complication, appropriate emergency care may favourably influence both maternal and fetal outcome. The very high risk of infant mortality in liveborn children of maternal deaths points to the strong links between child survival and maternal care.

Overall, the study has demonstrated that existing services are often too remote or have too little to offer, and that patients, logistics and health service factors combine to result in a medical intervention for a maternal illness being instituted far too late to be effective. The findings, which have been quantified for the first time, point to a need for inclusion of prompt and accessible medical management as an essential component of maternal mortality prevention programmes.

Acknowledgements

The study was funded by the World Health Organization (Safe Motherhood Research, Division of Family Health, grant No. M/183/263). The authors are grateful to Dr Banoo Coyaji for her guiding vision, Dr S.R. Otiv and Dr S.S. Hirve for their valuable inputs throughout the study, and Dr Kalyan Banerjee for his critique of the present paper. Cooperation extended by the Bureau of Vital Statistics, Maharashtra, the District Health Offices of the involved districts, the Municipal Corporation of Pune, and the Sassoon Hospital is gratefully acknowledged. Special efforts by the Aurangabad Medical College (in particular Dr V.L. Deshpande, Dr L. Bichale and Dr D.P. Bhavthankar) and the Pravara Medical College (especially Dr Kavade, Dr Goyal and Dr Shomsunderam) contributed greatly to the study. We thank Neelam Joglekar, Dileep Ghanwat, Rajendra Kale and J. Misal who assisted in collecting the data.

Résumé

La mortalité maternelle dans une zone rurale de l'ouest du Maharashtra (Inde): étude cas-témoins en communauté

De nombreuses complications de la grossesse ne peuvent être prévenues ou même prévues; cependant la mortalité maternelle peut être diminuée par une prise en charge rapide. Dans la présente étude cas-témoins en population on quantifie les déterminants de la survie en cas de complication de la grossesse, les décès maternels étant comparés aux femmes qui ont survécu à des complications comparables de la grossesse.

Un total de 121 décès maternels, identifiés grâce à plusieurs sources de surveillance dans 400 villages du Maharashtra, ont été recrutés de manière prospective de 1993 à 1995. Les odds ratios non ajustés comparant les décès aux témoins appariés sur les complications montrent une forte

association entre d'une part le nombre d'années d'étude du mari et la situation économique, et d'autre part la survie maternelle. Aucune relation statistique n'est observée entre le niveau d'éducation de la femme et le risque de décès maternel. Celui-ci est supérieur chez les femmes de moins de 20 ans ou de plus de 35 ans dont la situation maritale n'est pas monogamique, qui n'ont eu aucun contact avec le système de santé dans la période prénatale, ou qui ont accouché à la maison avec une accoucheuse non formée.

Le laps de temps qui sépare le début des complications et le décès ou la guérison a été subdivisé en plusieurs périodes: temps écoulé entre le début des symptômes et la décision de recours aux soins, temps écoulé entre cette décision et le premier contact avec le personnel de santé, et temps écouléentre ce premier contact et l'accès au centre de soins approprié. Une fois prise la décision de consulter, les cas mettent significativement plus de temps que les témoins pour recourir aux soins et prendre un premier contact avec le personnel de santé. En outre, la distance parcourue est significativement plus grande, ainsi que le nombre de centres contactés pour atteindre le service compétent.

L'analyse multivariée montre l'effet néfaste de trop nombreux recours successifs et l'effet bénéfique de divers facteurs, notamment: présence d'une sagefemme formée à l'accouchement ou d'un infirmier résidant dans le village, lieu de résidence dans le village ou à proximité, niveau d'instruction du mari, et le fait pour la femme de séjourner chez ses parents lors de la maladie. Les enfants nés vivants dont la mère est décédée ont un risque significativement plus élevé de mourir durant leur première année.

D'autres résultats importants ont été obtenus: si les décès imputables à la violence au foyer ne sont pas inclus dans la définition de la mortalité maternelle, ils représentent toutefois la deuxième grande cause de mortalité liée à la grossesse. Plus des deux tiers des décès maternels ne sont pas déclarés dans les statistiques officielles.

L'étude montre la nécessité des efforts à réaliser pour informer, éduquer et communiquer afin développer la préparation de la famille aux urgences (en particulier des hommes), la décentralisation de la prise en charge obstétricale avec un bon triage des patientes et la restructuration du système d'orientation-recours. Elle propose de plus d'adopter une définition plus simple de la «mort liée à la grossesse» comme définition de travail pour réduire le nombre d'erreurs de classification des décès et mettre la violence au foyer en tête de l'ordre du jour de la santé.

References

1. **Rosenfield A, Maine D.** Maternal mortality — a neglected tragedy: where is the M in MCH? *Lancet*, 1985, **2**: 83–85.
2. *Children and women in India: a situation analysis.* New Delhi, UNICEF, 1991.
3. Ministry of Health and Family Welfare. *National Child Survival and Safe Motherhood Programme.* GOI publications, 1991.
4. **Bhat M, Navaneetham P, Rajan SI.** *Maternal mortality in India: estimates from an economic model.* Dharwad, Population Research Center, 1992 (Working Paper No. 4).
5. **Chandrakapure MR, Ranganathan HN.** *Maternal mortality in rural Maharashtra.* Paper presented at: Obstetric and Gynecological Conference, Aurangabad, India, 1985.
6. **Ranganathan HN, Rode PP.** On a method of estimating level of maternal mortality in rural India from limited data. *Demography India*, 1994, **23**: 133–142.
7. **Filho-Campos N, Franco EL.** *A microcomputer programme for multiple logistic regression by unconditional and conditional maximum likelihood methods (MULTLR). A user's manual.* Saõ Paulo, Ludwig Institute of Cancer Research, 1988.
8. **Walker GJA et al.** Identifying maternal deaths in developing countries: experience in Jamaica. *International journal of epidemiology*, 1990, **19**: 599–605.
9. **Smith JC et al.** An assessment of the incidence of maternal mortality in the United States. *American journal of public health*, 1984, **74**: 780–783.
10. **Zahr CA, Royston E.** *Maternal mortality: a global fact book.* Geneva, World Health Organization, 1991.
11. **Bhatia JC.** Levels and causes of maternal mortality in southern India. *Studies in family planning*, 1993, **24**: 310–318.
12. **Khan AR, Jahan FA, Firoza Begum S.** Maternal mortality in rural Bangladesh: the Jamalpur district. *Studies in family planning*, 1986, **17**: 7–12.
13. **Allaudin M.** Maternal mortality in rural Bangladesh: the Tangail district. *Studies in family planning*, 1986, **17**: 13–21.
14. **Thaddeus S, Maine D.** Too far to walk: maternal mortality in context. *Social science and medicine*, 1994, **38**: 1091–1110.